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# Determinants of Success in the Automobile Industry in India: An Analysis of Foreign and Local Enterprise Data for 2000-2008\*

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## Abstract

Using district-level panel data of automobile and part-suppliers' production in India for 2000-2008, we found through regression analyses that production of the most successful foreign assembler is positively and strongly associated with the total value of part production and the size of part-supplier in the same district, indicating that this assembler developed the geographically dense production network. In contrast, the second most successful foreign assembler relies on parts production by suppliers of the same country origin and imports of parts, whereas local assemblers more heavily rely on their in-house production. These findings indicate that the key to the success lies in the use of local part-suppliers by means of investment in incapacity building.

**Keywords:** Automobile industry, parts production, local enterprises, foreign enterprises

**JEL Classification Code:** F23, L16, O14.

## I. INTRODUCTION

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Foreign direct investment (FDI) has significantly increased over the last several decades. World development indicators show that FDI inflow to developing countries drastically increased from 0.6% of their GDP in 1990 to 2.7% in 2007. Since foreign multi-national companies bring not only capital but also advanced technologies and management know-how to developing countries, assessment of the role of FDI in the growth process of industries is a critical issue in the economic development of developing countries including India.

A lot of empirical studies on the impacts of FDI on host-country economies have been carried out. For example, meta-analysis of Havranek and Irsova (2011) examines 3,626 results obtained by more than 100 economists about the impacts of FDI and generally finds the positive effects of FDI on the development of upward industries producing parts and components. In the Indian context, Kathuria (2001; 2002) and Fujimori and Sato (2015) examine the FDI spillover effect mainly on part-suppliers in the manufacturing industries. The literature commonly assumes that the major way by which FDI, typically engaged in the assembly, affects the development of the domestic industry is information spillover to part-suppliers. The existing studies generally use industry level data, not the firm level data, importantly because the unavailability of firm level data. However, while some foreign companies train local part-suppliers in order to improve their production capacity and heavily rely on them, other foreign companies rely on the supply of parts by the foreign companies of the same origin and imported parts and materials. Thus, in order to understand the success and

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failure of FDI, the analysis of the data capable of analyzing impacts of FDI on the development of local part-supplying industries is indispensable.

The purpose of this study is to test the hypothesis that the major impact of FDI on the development of the domestic industry is not through information spillover but investment of foreign firms in a capacity enhancement of local part-suppliers. We presume that if information spillover is important, absorptive capacity of local enterprises matters in the development of local industries, whereas if the investment in capacity enhancement is important, part procurement policies of foreign enterprises matter. If our hypothesis is correct, we expect to observe the significantly improved performance of local part-suppliers located near the foreign enterprise, which invests in their capacity, and its absence in the vicinity of foreign enterprises, which do not invest in their capacity.

To test our hypothesis, we focus on the Indian automobile industry. India is the fourth largest automobile market in the world in 2017. A Japanese company, Maruti-Suzuki, gains as much as 50% share in this market. Major local assemblers, Tata and Mahindra, and a Korean company, Hyundai, have achieved relatively decent markets shares of 10 to 20%, while other foreign assemblers are far smaller. Such difference between successful and less successful assemblers allows us to examine the determinants of success and failure in the automobile industry with special focus on the relationship between the assemblers and their parts suppliers.

This study uses the district-level data from 2000 to 2008, when each major foreign assembler operated one factory. Taking advantage of the fact that we can obtain production

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data of major assemblers and part-suppliers at the district data, we regressed the total size of automobile parts production and average size per part-supplier in the district on the number of automobiles produced by the assembler, and its interaction terms with the same district dummy and adjacent district dummy. We found that production of Maruti-Suzuki is positively and strongly associated with the parts production in the same district and the average size of part-suppliers, indicating that this assembler invested in the capacity of local-suppliers and developed the geographically dense production network. In contrast, Hyundai relies on parts production by part-suppliers of the same country origin and imports of parts and materials, which clearly indicates the absence of information spillover from Hyundai to local part-suppliers. Local assemblers more heavily rely on in-house production of parts, rather than outsourcing to local part-suppliers, whereas the production of other foreign assemblers is only modestly associated with the local part production. These findings suggest that active investment in the capacity of local part-suppliers is the key to success of the foreign enterprise in the Indian automobile industry.

The organization of the rest of the paper is as follows. In Section II, we briefly explain the relevant features of the Indian automobile industry. Section III proposes our testable hypotheses. Section IV provides a discussion of the dataset and the variables used, whereas Section V presents the estimation function followed by the examination of the estimation results in Section VI. Section VII concludes the paper.

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## II. AN OVERVIEW OF INDIAN AUTOMOBILE INDUSTRY

The Indian automobile industry is one of the largest in the world, and the speed of production growth is one of the fastest. Maruti-Suzuki is the largest player in this industry and gains 47 percent market share in the calendar year 2016 (SIAM, 2017). Figure 1 shows the number of passenger cars produced by Maruti-Suzuki, Hyundai, local assemblers (Tata and Mahindra combined), and all other foreign FDI (Honda, Toyota, Ford, GM, Fiat, Mitsubishi, and Mazda) for the period 2000-2013. Although each group of assemblers increased their production volume, the volume of Maruti-Suzuki has been predominant and more than twice as large as others. It is interesting to note that the share of Hyundai became higher for 2007-09 but other two groups surpassed that of Hyundai in recent years.

<Insert Figure 1 here>

Maruti-Suzuki is not a first FDI in the Indian automobile industry. General Motors established an assembly plant in 1928 to assemble cars using imported parts from the USA. Following this, Ford Motor Company established assembly plants in 1930. The Indian government, however, required them to produce a car with the locally produced parts, which led General Motors and Ford Motors to cease their operations in India in 1953. After closure of those American automobile companies, local assemblers, such as Hindustan Motors and the Premier Automobiles, produced cars that were low quality but expensive for personal transportation in India. These episodes indicate the importance of the part industries in the production of automobiles.

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Under such circumstances, the Indian government supported a public sector company, the Maruti Udyog Limited, to produce a cheap and reasonable quality car. For that purpose, Maruti Udyog Limited needed a foreign collaborator, and Suzuki Motors volunteered to be selected in 1981. After economic liberalization in 1991, the regulation on local contents of parts was relaxed and other foreign assemblers also entered into the Indian automobile industry. General Motors and Ford reentered in 1994 and 1995, respectively. In the late 1990s, Honda, Toyota, Hyundai, and Fiat participated in the automobile industry.

Meanwhile, Tata and Mahindra Motors were established in 1945. Those two dominant domestic manufacturers of commercial vehicles entered the passenger car segment during the early 1990s with multi-utility vehicles and later with small cars. They have been competing with foreign assemblers and succeeded in gradually increasing their production and market shares.

The fundamental question is why the market share of Maruti-Suzuki has been so dominant, despite the fact that Suzuki is by no means a leading automobile company in Japan. Note, however, that Suzuki Motors in Japan specializes in low-priced compact cars. The second question is why Hyundai was prospering, at least temporarily and also compared with many other foreign assemblers except for Maruti-Suzuki, but decreased its growth rate after 2008/09. In contrast, the growth rates of automobile production of local assemblers as well as other foreign assemblers had been slow from 2000 to 2008, which is the period this study focuses on.

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### **III. HYPOTHESES**

In order for foreign company to succeed in local production in developing countries, it must fully utilize cheap local labor. The quality of local labor, however, is not as high as in the home country. Therefore, in order for foreign assembler to use local labor amply and effectively, it may have to sacrifice the quality of product and produce cheap ones, while purchasing cheap locally supplied parts by local part-suppliers. Such strategy may work, if consumers are relatively poor and, hence, their demand for cheap products is high. According to the literature, Maruti-Suzuki aimed to produce the low priced but reasonable quality cars and, hence, it invests extensively in the capacity of the local-part suppliers, especially small ones, to improve the quality of parts and components and to reduce their production costs (Aoki and Kumar 2014; D'Costa 1995; Okada 2004; Chatterjee 1990; Bhargava 2010; Horn, Forsans and Cross 2010; Humphrey 2003; Sutton 2004). Moreover, those local manufacturers must be located near the plant of Maruti-Suzuki in order to reduce not only the transport cost but also training cost. Based on such considerations, it seems reasonable to postulate the following hypothesis:

**Hypothesis 1:** *In order to reduce the production cost, the most successful automobile enterprise (i.e., Maruti-Suzuki) adopts the policy of producing low-quality, low-priced automobiles, while investing in the capacity of local-part suppliers located in the vicinity of its production base and relying on parts produced by them.*

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Table 1 shows the average prices of produced cars of Hyundai in Tamil Nadu and Tata and Mahindra combined in Maharashtra relative to that of Maruti-Suzuki for 2000-08.<sup>1</sup> The average price is measured as the average value of sales per car. The data are taken from Annual Survey of Industries (ASI). Consistent with the first part of Hypothesis 1, average price of passenger cars is far cheaper for Maruti-Suzuki than Hyundai and the major local assemblers.

<Insert Table 1 here>

Table 1 also shows the value added ratio (or ratio of value added to the sales value), which indicates the importance of in-house production of parts and components as opposed to their purchase from part-suppliers. Although the differences in the value added ratio are not large, it is clear that it is lowest in Maruti-Suzuki and highest in local assemblers. The low value added ratio of Maruti-Suzuki is consistent with the second part of Hypothesis 1 that this assembler invested in the capacity of local part-suppliers in order to use locally supplied cheap parts. On the other hand, the high value added ratio of Tata and Mahindra indicates that these local automobile assemblers tend to produce more parts in house, rather than purchasing from local part-suppliers.

Although ideally we would like to analyze the performance of individual automobile companies in terms of total factor productivity or profitability and its determinants, we have

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<sup>1</sup> We included only passenger vehicle assemblers, but not commercial vehicle assemblers in this study.



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neither access to such data nor do we have sufficient number of observations for direct statistical testing. Instead, we construct the district-level production data of assemblers by taking advantage of the fact that there are three major automobile-production centers in India, which are characterized by the distinctly different combination of assemblers. They are: (1) Haryana where Maruti-Suzuki alone dominates; (2) Maharashtra where only Tata and Mahindra, two major local assemblers, coexist; and (3) Tamil Nadu where Hyundai alone dominates. Several other small foreign assemblers operate in other states. We combined all other assemblers and treat them as if they belong to a single company because the size of each assembler is too small to identify statistically the impacts of its production on part-production in nearby areas.

As is shown in Table 1, Hyundai produces high price and high quality cars. Actually it exports one-third of their products in 2007, for which high-quality automobiles are required (Hyundai, 2008). Yet, the relatively low value-added ratio of Hyundai, shown in Table 1, suggests that it also actively outsources the production of parts. Since it is difficult for the Indian local part-suppliers to producing high-quality parts, Hyundai depends on Korean suppliers. Korean suppliers are located in industrial parks near Hyundai's plant.<sup>2</sup> In order to produce high-quality parts, those suppliers import the materials or other inputs from Korea or other advanced countries. Thus, we would like to propose the following hypothesis regarding Hyundai:

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<sup>2</sup> We confirmed the location of those Korean suppliers using the database of Marklines, which is online information services specific to the automotive industry.

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Hypothesis 2: *The second most successful foreign automobile enterprise (i.e., Hyundai) adopts the policy of producing high-priced automobiles while relying on foreign part-suppliers and imported parts and materials.*

We must note that if information spillover from foreign assembler to local part-suppliers is important, we ought to observe the development of the local part-supplying industries in the vicinity of Hyundai's plant. The absence of such development strongly indicates the absence of information spillover to the local industries. Similarly, if the information spillover is important, we should observe the development of the part-supplying industries in areas where other foreign assemblers are located. Its absence indicates the absence of information spillover as well.

Column 3 in Table 1 suggests that the local assemblers produce relatively low priced cars. Actually they sell them only to the Indian domestic market. Their price, however, is far higher than Maruti-Suzuki and its value-added ratio is considerably higher. This suggests that the local assemblers produce the component parts in-house, either because unlike Maruti-Suzuki, it does not have capability to invest in the capacity of part-suppliers or because unlike Hyundai, it does not demand for high-quality parts produced by foreign part-suppliers. According to Table 2, which shows the number of part-suppliers for major assemblers by nationality as of

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2017, Tata and Mahindra seem to have procured parts primarily from local part-suppliers.<sup>3</sup>

Thus, we would like to postulate the following hypothesis for the local assemblers:

*Hypothesis 3: The local automobile enterprises (i.e., Tata and Mahindra) adopt the policy of producing high-priced automobiles while relying importantly on self-supplied parts without investing much in the capacity of local part-suppliers.*

<Insert Table 2 here>

#### **IV. KEY VARIABLES**

We use plant-level data for the period 2000/01 to 2007/08 from the Annual Survey of Industries (ASI) conducted by India's Central Statistical Office (CSO). ASI conducts surveys on the performance of the formal manufacturers registered in accordance with the Factory Act, 1948. The ASI factory frame is classified into two sectors: the census sector and the sample sector. The sample sector consists of small plants employing 20 to 99 workers if not using electricity and 10 to 99 workers if using electricity. The census sector consists of relatively large plants and it covers all units employing 100 or more workers and also some 'significant' units which, though employing fewer than 100 workers, contribute significantly to the value of output. In order to construct the dataset of the automobile parts industries at district level from

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<sup>3</sup> The reliance of Hyundai on Korean part-suppliers appears small in terms of the number of part-suppliers, but as we will see in Table 3, these Korean part-suppliers are large companies.

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ASI,<sup>4</sup> we used a sampling weight to restore the population. As a result, we constructed 549 districts data in each year. We also identified the districts in which each assembler is located using Markline database. Hereafter we call the part-suppliers located in the same districts as the assembler, "the suppliers in the same district". Moreover, we identified the districts adjacent to the district where each assembler is located, and hereafter we call the suppliers located in such districts as "the neighboring suppliers." We construct a database of the value of sales, gross value added, number of factories, number of employees, and the value of fixed asset within a district. These variables represent the proxy for size of the automobile part-supplying industries in a district.

We constructed the dataset of production volume of assemblers in terms of the number of automobiles produced for the period from 2000/01 to 2007/08 from the Society of Indian Automobile Manufacturers (SIAM) report. We classified the assemblers operating in India into four groups: 1) Maruti-Suzuki, 2) Hyundai, 3) local assemblers (Tata and Mahindra), and 4) other foreign assemblers (viz., Honda, Toyota, Ford, GM, Fiat, Mitsubishi, and Mazda).

Table 3 shows the descriptive statistics of district-level variables in 2002/03 and 2007/08 in relation to the location of major assemblers. Several important observations can be made from this table. First, although the part production in the district where Maruti-Suzuki was located in 2001/02 was small in terms of the value of sales, gross value added (GVA), number of factories, number of employees, and value of fixed assets, it dramatically increased

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<sup>4</sup> We use the 3-digit industry level code to identify the suppliers. The automotive parts suppliers are classified into the industrial classification 342 and 343 in National Industrial Classification (NIC) 98.

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from 2001/02 to 2007/08. This is partly because the Indian economy suffered from recession in the early years after the turn of the century and probably more importantly because many of the part-suppliers were too small to be included in official data in 2001/02. However, the number of part-suppliers and their sizes continued to increase over time. As far as 2007/08 is concerned, the part-supplying industries in the same district as Maruti-Suzuki's plant are exceedingly large. Second, in contrast, the neighboring suppliers are important in the case of Hyundai, which indicates that this assembler relied on foreign (mostly Korean) suppliers located in large industrial parks in adjacent district. In fact, average size of part-suppliers in the neighboring district of Hyundai's plant is decisively large compared with that in the same district where part-suppliers are predominantly local (see the 6<sup>th</sup> to 9<sup>th</sup> rows in Table 3). Third, the total size of part production in the neighborhood of local automobile assemblers is far smaller, indicating that they either did not invest in the capacity of local suppliers or produced parts in house, or both. Fourth, the average size of part-suppliers located near Maruti-Suzuki is decisively large, which suggests that this assembler invested in capacity of local-part-suppliers. Finally, it is worth emphasizing that imports of parts in neighboring district of Hyundai is large, which indicates that Korean suppliers located in nearby districts imported substantial amount of parts and materials probably from Korea. The amount of imports in neighborhood of Maruti-Suzuki is also large, but this is importantly because of the larger size of production of this assembler.

To sum up, the most important reason for Maruti-Suzuki to dominate in the Indian automobile market seems to lie in the production of low-quality, low-priced automobiles, while

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investing in the capacity of local-part suppliers located in the vicinity of its production base. Although it is beyond the scope of this study, a part of the reasons why Hyundai lost market share in recent years may be its failure to nurture local-part suppliers, which may potentially be able to supply “reasonable” parts at reasonable prices. If information spills over from Hyundai to local part-suppliers, Hyundai would have been able to procure locally produced parts more actively.

<Insert Table 3 here>

## V. ESTIMATION FUNCTION

In order to assess the validity of Hypotheses 1 to 3, we estimated the following regression function using district-level data for dependent variables and assembler-level data for independent variables:

$$\begin{aligned}
 y_{d,t} = & \alpha + \alpha_t + \alpha_d + \sum_i \beta_{1i} * x_{i,t} + \sum_i \beta_{2i} * x_{i,t} * D_d + \sum_i \beta_{3i} * x_{i,t} * ND_d \\
 & + \varepsilon_{d,t} \quad i \in \text{SUZUKI, HYUNDAI, LOCAL, OTHER FDI} ,
 \end{aligned}
 \tag{1}$$

where  $y_{d,t}$  are the outcome variables such as the value of sales, number of factories, gross value added, number of employees, the value of fixed asset, or value of imported inputs of the part-suppliers within district  $d$  in year  $t$ ;  $x_{i,t}$  is the number of automobiles produced by each group of assemblers  $i$  at year  $t$ ;  $D_d$  is a dummy variable, which takes 1 if assembler is located in district  $d$ , and otherwise takes 0;  $ND_d$  is also a dummy variable, which takes 1 if a district  $d$  is

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adjacent to the district where assembler is located, and otherwise takes 0; and  $\alpha_t$  and  $\alpha_d$  are the time fixed effect and the district fixed effect, respectively. The coefficient,  $\beta_{2i}$  or  $\beta_{3i}$ , shows how part-suppliers in the same or neighboring district increase their production when the assembler or assemble group increases the automobile production. On the other hand, the coefficient,  $\beta_{1i}$ , measures how much part-production increases in other districts when the automobile production increases in district  $d$ . Hypothesis 1 is supported if estimated  $\beta_{2i}$  is positive and large for Maruti-Suzuki; Hypothesis 2 is supported if  $\beta_{3i}$  is positive and large, including imports regression, for Hyundai; and Hypothesis 3 is supported if coefficients,  $\beta_{2i}$  and  $\beta_{3i}$ , are insignificant or small in magnitude for the local assemblers. Since automobile production is clustered to enjoy agglomeration economies associated with locational proximity, we expect that the coefficient,  $\beta_{1i}$ , is insignificant.

Note that the estimation of the equation (1) does not aim to identify the causality but correlation or association between the activity of assembler and that of the part-suppliers, because the former is endogenous. Identification of the causality requires instruments to control for the impacts of production of clustered part-suppliers on the production of automobiles. Although such instruments are hardly available, historical record indicates that part-suppliers were gradually established around the factory of assemblers, rather than the latter was established around the cluster of part-suppliers. Needless to say, however, the amount of production of automobiles and their parts will be mutually dependent.

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We also estimate equation (1) using the average production per plant or size of the plant as the dependent variables. We expect that to the extent that the assemblers invest in the capacity of local suppliers or rely on foreign part-suppliers, the coefficient,  $\beta_{2i}$  or  $\beta_{3i}$ , tends to be positive and large, even though we cannot deny the possibility that large part-suppliers were chosen by assemblers as transacting partners. If the information spillover is important, rather than assembler's conscious investment in capacity enhancement of part-suppliers, there does not seem to be strong reason to explain why the average size of part-supplier is much larger in the vicinity of Maruti-Suzuki than in that of other foreign assemblers.

## **VI. ESTIMATION RESULTS**

Table 4 presents the regression results of the impacts of assembler's production on the size of the automobile parts production in the same district, adjacent districts, and other districts, using district-level panel data. In columns 1 to 6 except column 3, we find that the part-suppliers in the district where Maruti-Suzuki is located significantly increase their production, employment, and value of asset when Maruti-Suzuki increases production, while the neighboring part-suppliers of Hyundai also increase their production, employment, and fixed assets when this assembler increases its production. These results are consistent with Hypotheses 1 and 2. The same tendency is observed for the number of part-supplying factories in column 3. It is also important to confirm that the marginal effects of Maruti-Suzuki and Hyundai on the part



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production in the same district or neighboring districts are significantly larger than those of local assemblers. The weak effect of the production of local automobile firms supports Hypothesis 3. We obtained the results similar to Maruti-Suzuki and Hyundai for other foreign assemblers, even though the magnitudes of impacts are smaller judging from the estimated coefficients.

<Insert Table 4 here>

Next, let us examine the average characteristics of the suppliers in respect of the size of production, employment, and fixed assets. As we argued earlier, we expect that to the extent that the assemblers invest in the capacity of local part-suppliers or they use foreign part-suppliers, the coefficients of the production of automobile assemblers are large. On the other hand, if local part-suppliers learn production technology through information spillover, there is no clear reason to assume that size of part-supplier tends to be particularly large in the vicinity of particular foreign assembler plants. Consistent with our expectation, the coefficients of Maruti-Suzuki in the same district and Hyundai in the adjacent district are large and significant, except for the number of employees where the coefficient of Hyundai is insignificant. These findings indicate that Maruti-Suzuki invested in the capacity of local suppliers so that the production size of local suppliers became similar to foreign part-suppliers. Such findings support Hypotheses 1 and 2. The absence of employment effect of Hyundai's plant indicates that Korean part-suppliers delivering their products to Hyundai did not employ significantly

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large number of employees. This is reasonable if these part-suppliers use modern labor-saving production methods.

<Insert Table 5 here>

The coefficients of local assemblers interacted with adjacent district dummy are positive and significant, even though they are much smaller than the coefficients of Maruti-Suzuki interacted with the same district dummy and Hyundai interacted with the adjacent district dummy. It may well be that local assemblers also invested in the capacity of local part-suppliers to some extent or they choose relatively large part-suppliers. This finding is not supportive of Hypothesis 3. Somewhat unexpectedly, the coefficients of other foreign assemblers (or other FDI) interacted with the same district dummy is insignificant and those interacted with the adjacent district dummy are negative and significant. Although it is difficult to interpret the latter result, it is likely that other foreign assemblers did not invest in the capacity of local part-suppliers significantly, not to mention the absence of information spillover effects in areas where many foreign assemblers operate.

Table 6 shows the estimation results using the value of imported input as a dependent variable. The result strongly indicates that the neighboring suppliers of Hyundai increase their imports when Hyundai increases the production, while the suppliers located in the same district as Maruti-Suzuki and other foreign assemblers also increase their import but to lesser extent. The marginal effect of the former is significantly larger than those of the latter. These results

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support Hypothesis 2. Also it is interesting to note that the production of local assemblers does not have any impacts on imports, indicating that these assemblers do not use imported parts or rely on foreign part-suppliers. These findings suggest that the part-suppliers of Hyundai either do not have enough capacity to produce all parts needed by Hyundai in India or rely on high-quality materials imported from other countries, notably from Korea.

<Insert Table 6 here>

## **VII. CONCLUDING REMARKES**

This study attempted to explore the determinants of success in the Indian automobile industry, using the district data of part production and production data of major assemblers from 2000 to 2008. Our estimation results showed that the sales, the gross value added, number of factories, number of employees, and value of fixed capital assets in the part production located in the same district as Maruti-Suzuki is positively associated with the production of automobiles by this automobile assembler. This implies that Maruti-Suzuki successfully built dense cluster of automobile production. Furthermore, the average size of part suppliers tends to be large in such a district, which suggests that Maruti-Suzuki invested in their production capacity. The majority of these suppliers are local and the average price of automobiles produced by Maruti-Suzuki is far lower than those produced by other assemblers. These observations indicate that the keys to the success of Maruti-Suzuki are to produce cheap, low-quality automobiles, to

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invest in the capacity of local part-suppliers, and to rely on cheap, low but acceptable quality parts produced by them.

Although the automobile production of Hyundai is also positively associated with the part production in neighboring districts, important part-suppliers are Korean firms and they import parts and materials probably from Korea. This suggests that Hyundai's production does not fully utilize cheap labor force in India, which will be manifested in cheap automobile parts. This is likely to be the major reason why Hyundai was not as successful as Maruti-Suzuki. Improving the capacity of local part-suppliers, however, would not be easy. In fact, the most successful local assemblers in India, Tata and Mahindra, also failed to nurture local part-suppliers to significant extent. There is also no indication that other foreign assemblers succeeded in the capacity development of local part-suppliers. How to improve the production capacity of local part-suppliers seems to be a major issue for the success of foreign direct investment in the automobile industry in India.

Our findings that impacts of foreign automobile assemblers on the local part production are significantly different cast doubts on the common approach of the existing studies on the impact of foreign direct investment on the development of local industries that treat foreign enterprises as a homogeneous group. There is also good reason to doubt the validity of the common assumption of the existing literature that the information spillover from foreign firms to local firms in upward industry plays a critical role in the development of local industries.

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Notably, absence of the development of the local part-supplying industry in the vicinity of Hyundai is clear evidence against the information spillover hypothesis. Also there was no evidence that the presence of foreign assemblers other than Maruti-Suzuki stimulated the development of local part-supplying industries. Although we cannot deny the potential importance of information spillovers from Maruti-Suzuki to local part-suppliers altogether, we should not overlook the fact that Maruti-Suzuki heavily invested in their training in order to procure parts of acceptable quality from them.

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Table 1. Average automobile price relative to that of Maruti-Suzuki and gross value added ratio of assembler by region for 2000-08<sup>a</sup>

	(1) Hariyana(Suzuki)	(2) Tamil Nadu (Hyundai)	(3) Maharashutora (Local Ass.)
Relative Price (Hariyana(Suzuki)=100)	100	263	239
Gross Value Added Ratio	16.95%	18.66%	20.61%

a. Local assemblers in Maharashtra refer to average of Tata and Mahindra.

Source: Author's calculation from the ASI data.



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Table 2. The number and proportions of part suppliers for major assemblers by nationality as of 2017<sup>a</sup>

	Maruti-Suzuki	Hyundai	Tata	Mahindra
All	664 (100)	251 (100)	941 (100)	892 (100)
Japanese	105 (16)	20 (8)	48 (5)	48 (5)
Korean	9 (1)	20 (8)	11 (1)	8 (1)
Indian	490 (74)	189 (75)	788 (84)	767 (86)
Others	60 (9)	22 (9)	94 (10)	69 (8)

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a. Numbers in parentheses are proportions.

Source: Marline.

Table 3. Characteristics of the same district and adjacent districts around factory of Maruti-Suzuki, Hyundai, and Local Assemblers (Tata and Mahindra) in terms of total size of production of automobile parts and average size per part-supplier in 2001/02 and 2007-08

Variable	2001/02										2007/08									
	Maruti-Suzuki		Hyundai		Local		Other Dis.		Maruti-Suzuki		Hyundai		Local		Other Dis.					
	Same Dis.	Neighboring Dis.	Same Dis.	Neighboring Dis.	Same Dis.	Neighboring Dis.	Same Dis.	Neighboring Dis.	Same Dis.	Neighboring Dis.	Same Dis.	Neighboring Dis.	Same Dis.	Neighboring Dis.	Same Dis.	Neighboring Dis.				
Sales (in Million Indian Rupee)	1,060	517	2,090	10,000	41,40	408	320	67,700	6,070	4,880	47,300	11,900	929	265						
GVA(in Million Indian Rupee)	331	80	725	2,860	1,230	149	66	24,200	2,490	2,010	18,200	5,470	471	118						
No. of factories	11	13	65	114	82	11	3	110	41	69	233	88	8	3						
No. of Employees	1,458	591	4,801	11,699	4,992	796	297	50,986	6,985	5,993	31,208	10,547	937	293						
Fixed Asset(in Million Indian Rupee)	848	65	915	4,260	2,720	247	123	17,800	1,880	1,450	11,700	3,180	370	74						
Average Sales(in Million Indian Rupee)	96	29	32	88	45	18	20	616	221	68	335	188	169	32						
Average No. of Employees	30	4	11	25	15	5	4	220	90	29	124	94	86	13						
Average Fixed Asset(in Million Indian Rupee)	133	27	74	103	56	32	21	464	273	87	176	170	139	30						
Import(in Million Indian Rupee)	77	3	14	37	31	10	8	162	94	21	81	86	50	9						
	131	19	89	1,850	259	20	50	8,990	273	236	6,500	517	14	10						

Source: Author's calculation from the ASI data.

Table 4. Impacts of assembler's production on the size of the automobile parts production in the same district, adjacent districts, and other districts

Dependent Variable	(1) Output	(2) GVA	(3) No. of factories	(4) No. of Labour	(5) Fixed Asset
Suzuki	976.6 (1,029)	258.7 (241.9)	0.000853 (0.00409)	0.000642 (0.000469)	508.0 (320.9)
Suzuki_V_D	109,291*** (5,622)	45,951*** (1,321)	0.157*** (0.0223)	0.103*** (0.00256)	28,994*** (1,753)
Suzuki_V_ND	2,621 (1,648)	615.2 (387.3)	-0.00405 (0.00655)	0.00228*** (0.000751)	754.9 (513.9)
Hyundai	12,908 (15,246)	1,582 (3,583)	0.0159 (0.0606)	0.00400 (0.00695)	2,025 (4,753)
Hyundai_V_D	7,248 (8,248)	3,465* (1,938)	-0.0642* (0.0328)	-0.000209 (0.00376)	1,749 (2,571)
Hyundai_V_ND	103,589*** (6,022)	41,473*** (1,415)	0.301*** (0.0239)	0.0557*** (0.00274)	19,626*** (1,878)
Local	-15,655 (18,344)	-1,917 (4,311)	-0.0215 (0.0729)	-0.00494 (0.00836)	-2,822 (5,719)
Local_V_D	35,102*** (4,250)	16,313*** (998.9)	0.0736*** (0.0169)	0.0258*** (0.00194)	4,017*** (1,325)
Local_V_ND	1,966 (2,158)	519.4 (507.3)	-0.00393 (0.00857)	0.000165 (0.000984)	721.5 (672.9)
Other_FDI	-1,519 (3,777)	-144.7 (887.7)	-0.000351 (0.0150)	-0.00103 (0.00172)	-770.9 (1,178)
Other_FDI_V_D	63,601*** (5,584)	28,349*** (1,312)	0.107*** (0.0222)	0.0350*** (0.00255)	7,092*** (1,741)
Other_FDI_V_ND	299.9 (2,928)	1,819*** (688.2)	0.0518*** (0.0116)	0.00198 (0.00133)	218.5 (913.0)
Constant	1.124e+09 (1.336e+09)	4.233e+07 (3.139e+08)	6,250 (5,305)	466.9 (608.8)	2.306e+08 (4.164e+08)
Observations	4,034	4,034	4,034	4,034	4,034
District FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
R-squared	0.241	0.511	0.094	0.444	0.118
Number of districts	549	549	549	549	549

Source: The ASI data.

Table 5. Impacts of assembler's production on the average size of the automobile parts production per enterprise in the same district, adjacent districts, and other districts

Dependent Variable	(1) Average Sales	(2) Average GVA	(4) Average No. of Employees	(5) Average Fixed Asset
Suzuki	49.01 (46.89)	23.21 (16.73)	-0.0219 (18.85)	-5.06e-06 (3.01e-05)
Suzuki_V_D	984.5*** (256.1)	413.4*** (91.36)	222.8** (102.9)	0.000853*** (0.000164)
Suzuki_V_ND	346.8*** (75.09)	49.64* (26.78)	109.4*** (30.18)	0.000282*** (4.81e-05)
Hyundai	-637.1 (694.6)	-325.4 (247.8)	-408.0 (279.2)	-0.000870* (0.000445)
Hyundai_V_D	630.9* (375.7)	58.47 (134.0)	176.8 (151.0)	0.000379 (0.000241)
Hyundai_V_ND	980.2*** (274.4)	270.1*** (97.87)	175.8 (110.3)	0.000403** (0.000176)
Local	732.7 (835.7)	390.3 (298.1)	436.9 (335.9)	0.00104* (0.000536)
Local_V_D	198.4 (193.6)	198.7*** (69.07)	114.5 (77.82)	0.000232* (0.000124)
Local_V_ND	555.8*** (98.33)	222.8*** (35.08)	142.8*** (39.52)	0.000333*** (6.30e-05)
Other_FDI	50.53 (172.1)	6.194 (61.38)	74.54 (69.16)	0.000105 (0.000110)
Other_FDI_V_D	175.4 (254.4)	110.5 (90.75)	-24.50 (102.2)	-1.46e-05 (0.000163)
Other_FDI_V_ND	-913.7*** (133.4)	-24.11 (47.59)	-243.4*** (53.62)	-0.000615*** (8.55e-05)
Constant	-6.545e+07 (6.085e+07)	-3.945e+07* (2.171e+07)	-2.865e+07 (2.446e+07)	-72.42* (39.01)
Observations	4,034	4,034	4,034	4,034
District FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
R-squared	0.036	0.046	0.014	0.044
Number of districts	549	549	549	549

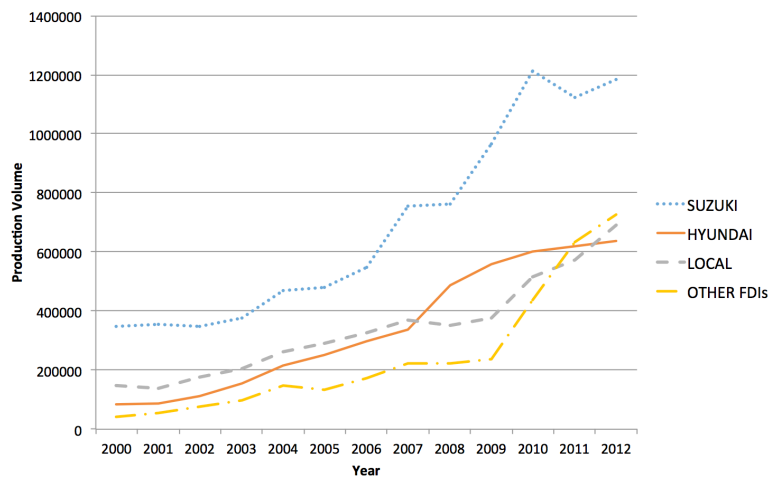
Source: The ASI data.

Table 6. Impacts of assembler's production on the value of suppliers' imported inputs in the same district, adjacent districts, and other districts

Dependent Variable	(1) Value of Import
Suzuki	236.3 (200.6)
Suzuki_V_D	13,469*** (1,096)
Suzuki_V_ND	603.2* (321.2)
Hyundai	3,386 (2,971)
Hyundai_V_D	1,415 (1,607)
Hyundai_V_ND	20,644*** (1,174)
Local	-4,124 (3,575)
Local_V_D	1,195 (828.2)
Local_V_ND	324.8 (420.6)
Other_FDI	-514.3 (736.0)
Other_FDI_V_D	2,906*** (1,088)
Other_FDI_V_ND	-1,769*** (570.7)
Constant	-6.704e+07 (5.989e+07)
District FE	YES
Year FE	YES
Observations	4,034
R-squared	0.133
Number of districts	549

Source: Author's calculation from the ASI data.

Figure 1. Number of Passenger Cars Produced by Each Assembler and Assembler Group for the Period 2000-2013



Source: Author's calculation from SIAM data.